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By-Plattor, Emma E.; Woestehoff, Ellsworth S.

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Effective instructional organization and sequences cannot be generated without analyzing and interpreting diagnostic information. Currently the teacher is required to provide the analysis and interpretation as well as the instruction. Class loads and time limitations preclude anything other than the cursory examination of data. In order to facilitate effectiveness and efficiency, a computer can assume the analysis function and free the teacher for careful interpretation and competent instruction. The utilization of a computer in educational diagnosis involves (1) identifying information categories requisite to educational diagnosis, (2) specifying category variables, (3) selecting instruments for obtaining data, (4) organizing files for data storage and retrieval, (5) developing a library of computer programs based on anticipated diagnostic procedures, (6) specifying data presentation format, and (7) translating the data into instructional sequences. Two exhibits of the application of computer technology to educational diagnosis are described and illustrated. Data tables are included. (BS)

Emma E. Plattor
Assistant Professor of Education
Tulane University
New Orleans, Louisiana

Ellsworth S. Woestehoff
Associate Professor of Education
The University of Rochester
College of Education
Rochester, New York

THE APPLICATION OF COMPUTER TECHNOLOGY TO EDUCATIONAL DIAGNOSIS

Research Report: Diagnosis and Disabilities

Over the past decade or more, computer technology has become a reality in the field of education. In general, the application of this technology has been confined to storage and retrieval of data for administrative purposes. Research in the use of the computer as a teacher-surrogate is being given limited attention.

Effective instructional organization and sequences cannot be generated without appropriate analysis and interpretation of diagnostic information. The typical procedure has required the teacher to provide the analysis and interpretation as well as the instruction. From the standpoint of both effectiveness and efficiency, the computer can best assume the analysis function, thus facilitating more extensive diagnostic interpretation and freeing the teacher for the more important task

of instructional implementation. This paper offers a report of research designed to demonstrate that computer technology has the potential to provide significant and direct assistance to instruction through analysis of a wide range of pupil data.

Educational Diagnosis and Data Analysis

In the typical school situation, the numerical magnitude of pupil enrollments has led teachers and administrators to use standardized test data as the major information upon which to base the organization and implementation of instruction. These data have generally been concerned with academic potential (mental ability) and achievement. Test scores are converted into standard measures, either stanines or grade equivalents, generally by the teachers, and the data are stored in the form of pupil lists. Storage is typically in student files or teachers' desk drawers.

In addition to administering the tests and scoring and recording the data, teachers are generally expected to interpret the test results and translate these results into action programs of instruction. Rarely is the magnitude of this task considered. For example, a third grade teacher who administers only two test instruments, such as the Stanford Achievement Test and the California Test of Mental Maturity, neither of which can be scored by machine, will score, convert into standard data, and list seven achievement subtests and sixteen mental ability subtests for each pupil in the class. If the class consists of thirty pupils, the teacher has worked with 690 individual pupil scores as a result of the administration of only two standardized tests. If readiness testing, diagnostic testing, interest testing, or

aptitude testing are added on a regular basis during the pupil's school career, the amount of pupil data collected and available at any given time is enormous.

Using these data effectively without assistance is clearly impossible. Even if psychometrists were available in every school system, which is not likely to be the case in the foreseeable future, time would preclude such personnel from providing data analyses sufficiently soon after test administration to allow the data to be useful. Nor do psychometrists possess the physical capacity to provide interactive analyses among the various data for each pupil in a typical school or school system.

The prescription and implementation of effective instructional sequences requires that the diagnosis of learning behaviors be as exact as possible. This includes both the evaluation of specific pupil performance behavior prior to the inception of instruction and the modification of learning programs in terms of both individual pupil behaviors and patterns of behaviors within a given group of pupils. Data must therefore be examined not only on the basis of individual subtests, but in terms of the interaction of these subtests for each child and for groups of children. In addition, data other than standardized test scores must be made available to the teacher to be considered in instruction. The computer is ideally suited to this task.

Applying Computer Technology to Educational Diagnosis

The following examples serve to illustrate the application of the concept of computer assisted instructional diagnosis to a specific school situation.*

Exhibit A is a computer histogram analysis of raw scores data obtained from the administration of the Bond-Clymer-Hoyt Silent Reading Diagnostic Test (SRDT) to 280 fourth grade pupils in the two elementary schools in which this research took place. This histogram analyzes data obtained from the three subtests which comprise the Visual Analysis section of the test. These include Subtest Four, Locating Elements; Subtest Five, Syllabication; and Subtest Six, Locating Root Words. This type of analysis was selected because it provides a methodology for the visual examination of (1) score distributions; (2) means, quartiles, and ranges; (3) comparisons among classes at a given grade level and (4) individual pupil disabilities and strengths. Similar histograms were done for each individual subtest of the SRDT and for the combined subtests in the areas of Recognition Pattern, Phonetic Knowledge, and Word Synthesis.

This computer analysis also provides means, standard deviations, and high and low scores by class and grade level for each variable. The computer was further programmed to indicate the number of pupils

*The New Orleans Education Improvement Project provided the setting for this research. This project, funded by the Ford Foundation, was established as a compact of colleges and schools to improve the education of disadvantaged children in two intact elementary schools serving a predominantly Negro neighborhood in New Orleans, Louisiana. The authors served as consultants to this project at the time during which the research reported in this paper was conducted.

and the percentage of pupils at or above grade level for each of the variables tested. In order to make the visual analysis even more distinct, the interval containing the norm grade equivalent for this level (4.0) was bracketed by the programmer. At this grade level, only 37% of the pupils achieved a grade equivalent at or above grade level in <u>Visual Analysis</u>. Since the computer can also be programmed to print the names of those pupils who appear as "stars" at any interval or group of intervals on the histogram, this type of analysis facilitates the provision of individualized and group instruction in specific reading skills.

Computer analyses can also be made of children who have difficulty with more than one diagnostic area in reading, such as <u>Visual Analysis</u> and <u>Phonetic Analysis</u>. Further, the computer can identify those children who have difficulty in certain areas on the SRDT, and also appear at any particular range or interval on the test of mental ability. Thus, interactive data analysis become feasible.

Tables I and II present the same histogram analyses for the fifth and sixth grade levels in the same schools. Visual examination of <u>Exhibit A</u> as well as <u>Tables I and II</u> clearly demonstrate the degree to which difficulty in the area of <u>Visual Analysis</u> skills decreases with each succeeding grade level.

Tables III, IV, and V present the same histogram ana[illegible] data obtained from the four subtests which comprise the [illegible] Analysis section of the SRDT, also for grades 4, 5, and 6 in the same schools. It is interesting to note that the numbers of pupils at grade level or above in this skill is vastly different at each grade

level from the numbers at grade level in <u>Visual Analysis</u>. In addition, the percentage of pupils at grade level in <u>Phonetic Analysis</u> decreases between fourth and sixth grade, where it increased in <u>Visual Analysis</u>. The computer can also provide interactive information as to whether the "stars" representing pupils at grade level in <u>Phonetic Analysis</u> also represent the same pupils in the area of <u>Visual Analysis</u>.

As the data obtained during this research were analyzed by the computer, it was found that a general discrepancy existed between the Language and Non-Language I.Q. scores obtained on the <u>California Test of Mental Maturity</u>. This discrepancy was found at all grade levels, and was in the direction of the Non-Language I.Q.'s. In many instances, this discrepancy was statistically significant (15 points or more).

In order to determine the degree and impact of the influence of this discrepancy, the following computer analysis was made. For each pupil at each grade level, the Language I.Q. was subtracted from the Non-Language I.Q. The higher Non-Language-Language discrepancy was designated "positive"; the higher Language-Non-Language discrepancy was designated "negative". Five pupil categories based on positive and negative discrepancies were generated.

<u>Exhibit B</u> is a computer histogram analysis of these discrepancy categories in terms of total I.Q. for all children at the first grade level in the two schools. Examination of the histogram immediately reveals that positive discrepancies which are statistically significant exist for more than half of the first grade population. About

45% of the group show positive discrepancies of more than 20 I.Q. points. In addition, the higher the I.Q., the greater the positive discrepancy. Thus, the brightest children tend to have the greatest difficulty with those language elements tested with the California Test of Mental Maturity.

In a diagnostic sense, this histogram would indicate the need for concentration at the first grade level on developmental language activities as well as the desirability of further research into the reasons for these large discrepancies. Computer printouts can also be used to identify children with large positive discrepancies and specific readiness difficulties. Thus, prescriptions for instructional treatments can be derived based on meaningful diagnoses. Outcomes may be predicted more effectively as well.

Considerations in Computer Diagnosis

The utilization of the computer in educational diagnosis involves the following considerations:

1. Identification of information categories required for educational diagnosis.
2. Specification of variables within the categories.
3. Selection of instrumentation for obtaining data concerning specific variables.
4. Organization of files for data storage and retrieval.
5. Development of a library of computer programs based upon anticipated diagnostic procedures.
6. Specification of the format for presentation of data.
7. Translation of the data into instructional sequences.

Of these elements, the teacher as diagnostician must assume the responsibility for the identification of the information categories (1); the specification of the variables for which information is needed to prepare instruction (2); the selection of instrumentation for obtaining data concerning these variables; and the translation of these data into instructional sequences (7). The remaining tasks (4, 5 and 6), should be assumed by the computer specialist. To date, the teacher has been expected to organize the files for data storage (generally in the form of cumulative record folders) and retrieval. Anyone who has attempted to work with cumulative folders knows how difficult it is for teachers to record all pertinent data and keep the folders up to date in such a manner that the data are useful and current. Teachers have also been expected to specify the format for presenting the data (making graphs, charts, lists, etc.) as well as understand the statistical analyses of the data and use these analyses in interpretation. The impossibility of functioning in all of these roles, as well as the press of time and pupil numbers, has generally precluded anything but the most cursory examination of data, and has virtually excluded the effective and efficient use of data in instruction.

At this point in time, it would appear most feasible, to allow the computer to analyze and interpret pupil data and to allow the teacher to implement instruction based on information provided through computer analysis. In this regard, the role of the computer specialist in education becomes a vital one. To the extent that the computer specialist clearly understands the role of the teacher in diagnosis,

prescription and implementation of instruction, and to the extent that he understands the test instruments, he will be able to determine most effectively the techniques for assisting the teacher through the use of the computer. Perhaps this suggests the need for a new position in education: the instructional computer specialist. The research reported in this paper clearly indicates that this is a possibility worth investigating.

(PRINTED INTERVAL DESIGNATIONS ARE LOWER LIMITS OF CLASS INTERVALS)

	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7	GROUP 8	GROUP 9	GROUP 10
SPECIAL VALUES										
99.= NO SCORE										
98.= INVALID										
99.000)	***	*	*		***	*	*		***	*
98.000)										

TABULATIONS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES

INTERVAL	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7	GROUP 8	GROUP 9	GROUP 10
84.000)										
80.000)						**				
76.000)			***			*				**
72.000)		**	**********	**		***		*		**
68.000)		*******	***********	**	***	***				*******
64.000)	******	*****	*******	*****	*	****	***	***	*	**
60.000)	****	*****	****	**********12	****	***	*****	*****	**	****
56.000)	***	******	*	*****	***	****	*	***	**	**
52.000)	*	***		****	*****	***	**	*	**	**
48.000)	***	***	*	***	********	**	***	*	**	*
44.000)	*		*	**	**	**	***	***	**	
40.000)					****		*****	***	*	
36.000)	**	*			*	*	**		**	*
32.000)				*	*		*	*	*	
28.000)							*		****	*
24.000)				*					**	
20.000)						*				
16.000)							*			
12.000)										
8.000)									*	
MEAN	56.950	61.281	67.972	58.000	52.750	60.793	48.741	54.905	42.136	62.292
S DEV	9.265	8.085	7.393	9.695	9.544	13.214	12.123	10.663	14.584	11.566
N	20.	32.	36.	37.	32.	29.	27.	21.	22.	24.

INTERVAL INCLUDING GRADE EQUIVALENT OF 4.0

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED)

MEAN	57.2679
S DEV	12.5159
MAXIMUM	83.0000
MINIMUM	8.0000

TOTAL N = 280
NO. AT GRADE LEVEL OR ABOVE = 104
% AT GRADE LEVEL OR ABOVE = 37.1

HISTOGRAMS OF BOND-CLYMER-HOYT VISUAL ANALYSIS SCORES FOR FOURTH GRADE CLASSES

VARIABLE 8 (TOTAL I.Q.)

DISCREPANCY RANGES	← : -11 GROUP 1	-10 : -1 GROUP 2	0 : +10 GROUP 3	+11 : +20 GROUP 4	+20 : → GROUP 5

SPECIAL VALUES

999.= NO SCORE

998.= INVALID

999.000)**********56

998.000)***

TABULATIONS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES

INTERVAL (SCORES)	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
128.000)					
124.000)			*	*	**
120.000)			*		
116.000)		*	**		**
112.000)				**	****
108.000)		*			*****
104.000)	*	*	*	*****	*****
100.000)		**	****	**	********
96.000)	*	**	*****	***	**********15
92.000)	*	**	****	**********	**********17
88.000)		****	**	*****	**********17
84.000)		*	*******	*****	**********13
80.000)	*	*****	**	********	******
76.000)	*		**	*******	**********
72.000)		***	******	**********	***********
68.000)	*	**	**	*****	********
64.000)	*	***	***	**	***********
60.000)	*	*	*****	****	**
56.000)	***		***	*	***
52.000)	*	**	*		*
48.000)		**	***	*	
44.000)		*			
MEAN	73.000	80.182	81.778	83.768	87.445
S DEV	17.378	18.317	19.166	14.972	14.972
N	12.	33.	54.	69.	137.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED)

MEAN	84.2557
S DEV	16.5303
MAXIMUM	127.0000
MINIMUM	47.0000

EXHIBIT B HISTOGRAMS OF CTMM TOTAL I.Q.'S BY VARYING DISCREPANCY LEVELS FOR FIRST GRADE CLASSES.
(FALL TESTING, 1966)

NEW ORLEANS EDUCATION IMPROVEMENT PROJECT

(PRINTED INTERVAL DESIGNATIONS ARE LOWER LIMITS OF CLASS INTERVALS)

```
           GROUP 1     GROUP 2     GROUP 3     GROUP 4     GROUP 5     GROUP 6     GROUP 7     GROUP 8     GROUP 9     GROUP 10
          .........+...........+...........+...........+...........+...........+...........+...........+...........+..........+
SPECIAL
 VALUES
 99.= NO SCORE
 98.= INVALID
 99.000 )*         **          *******     **          **          **          ****        ****        ***         *
 98.000 )

        TABULATIONS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
INTERVAL

100.000 )
 96.000 )
 92.000 )
 88.000 )
 84.000 )                              *                                                               *
 80.000 )*****                 *       ***         ****                                                *
 76.000 )*********  *          **      ***         *                       *           *           ***         *
 72.000 )*******    ***        *       *******     ****        *           *****                   ******      ***
 68.000 )******     ********   ***     *********   **********  ***         *****       ***         ******
 64.000 )**         ***        ****    ******      *****       ***         ***         ****        ****        *****
 60.000 )           ***        ***     *           *           **          ***         **          ****        ***
 56.000 )           **         **                  *           ***         **          *******     ***         ***
 52.000 )           *          *                               ****        **          **                      **
 48.000 )           *          *       *                       ****        ***         *                       ****
 44.000 )                      *                   *           *                       *                       *
 40.000 )                      *                               **
 36.000 )           *          *                                           **          **                      **
 32.000 )                      *                   *           **
 28.000 )           **                                                                 **          *           **
 24.000 )                                                                                                      **
 20.000 )                      **
 16.000 )                      *
 12.000 )                                                                              *                       *
  8.000 )                      *

MEAN       74.862      61.880      54.423      70.968      68.464      55.080      62.346      55.077      68.103      53.207
S DEV       4.955      13.280      19.862       7.139      10.254      10.966      11.005      14.447      11.255      16.757
N          29.         25.         26.         31.         28.         25.         26.         26.         29.         29.
```

INTERVAL INCLUDING GRADE EQUIVALENT OF 5.0

```
ALL GROUPS COMBINED      (SPECIAL VALUES EXCLUDED)        TOTAL N                      = 273
                                                          NO. AT GRADE LEVEL OR ABOVE  = 117
          MEAN       62.7664                              %  AT GRADE LEVEL OR ABOVE   =  42.9
          S DEV      14.4837
          MAXIMUM    90.0000
          MINIMUM     9.0000
```

HISTOGRAMS OF BOND-CLYMER-HOYT VISUAL ANALYSIS SCORES FOR FIFTH GRADE CLASSES

```
                         (PRINTED INTERVAL DESIGNATIONS ARE LOWER LIMITS OF CLASS INTERVALS)

        GROUP  1    GROUP  2    GROUP  3    GROUP  4    GROUP  5    GROUP  6    GROUP  7    GROUP  8    GROUP  9
        ..........+..........+..........+..........+..........+..........+..........+..........+..........+
SPECIAL
 VALUES
 99.= NO SCORE
 98.= INVALID
 99.000 )*          **          *           ***         *                       *           *
 98.000 )

        TABULATIONS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
INTERVAL
                                                                                                                INTERVAL INCLUDING
                                                                                                                       GRADE
 88.000 )                                                                                                           EQUIVALENT
 84.000 )*          *           *********               **          *                                                 OF 6.0
 80.000 )**         *****       *********14**           ****        *                       *           **
 76.000 )**********12*********11****        ****        ***         ******      **          **          ****
 72.000 )********** *******     **          ****        ******      *******     ****        ****        ******   <--
 68.000 )*****      ******      ***         ********    *****       ****        **          ******      *******
 64.000 )**         **          *           *****       *           ****                    **          ****
 60.000 )*                                  **          *                       *****       *           **
 56.000 )           *           *                                               ***         **
 52.000 )                                   ***                                 *           **
 48.000 )                                                                       ***         *
 44.000 )                                   *                                   **          *
 40.000 )                                               **                      *
 36.000 )                                   *
 32.000 )                                                           *                                   *
 28.000 )                                                                       *                       *
 24.000 )
 20.000 )                                                           **
 16.000 )                                                                       *
 12.000 )                                                           *

MEAN        74.697      74.909      79.235      67.300      72.208      65.519      57.640      66.000      68.370
S DEV        4.934       5.692       6.656      10.219      11.026      19.500      14.821       9.497      11.596
 N          33.         33.         34.         30.         24.         27.         25.         22.         27.

        ALL GROUPS COMBINED        (SPECIAL VALUES EXCLUDED)                  TOTAL N                       = 255
                                                                              NO. AT GRADE LEVEL OR ABOVE = 113
                    MEAN          70.1608                                     %   AT GRADE LEVEL OR ABOVE =  44.3
                    S DEV         12.4212
                   MAXIMUM        87.0000
                   MINIMUM        13.0000
```

HISTOGRAMS OF BOND-CLYMER-HOYT VISUAL ANALYSIS SCORES FOR SIXTH GRADE CLASSES

```
                                   (PRINTED INTERVAL DESIGNATIONS ARE LOWER LIMITS OF CLASS INTERVALS)

          GROUP  1  GROUP  2  GROUP  3  GROUP  4  GROUP  5  GROUP  6  GROUP  7  GROUP  8  GROUP  9  GROUP 10
         .........+.........+.........+.........+.........+.........+.........+.........+.........+.........+
SPECIAL
 VALUES
999.= NO SCORE
998.= INVALID
999.000 )***      *         *                   ***       *         *                   ***       *
998.000 )

       TABULATIONS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
INTERVAL

112.000 )
108.000 )         *                                                                               *
104.000 )                                                 *
100.000 )                   *         *                                                           *
 96.000 )         *                                       *                                       *
 92.000 )         *         ****      *                   ***                                     ****
 88.000 )                   **                            *                                       *
 84.000 )**       ***       **        **                  **        *         *
 80.000 )**       ***       *******   *****               ***                 *                   *
 76.000 )*        ***       ******    ***       *         **        *         **                  ***
 72.000 )***      *         ********  ******    **        *         **        *         *         ***
 68.000 )***      ********  ****      ***       ***       **                  ***       *         *
 64.000 )******   ***       *         ****      ***       *****     *         *****     **        ****
 60.000 )*        *         *         **        ******    ****      ***                 *         **
 56.000 )         **                  ****      **        **        **        **        ****
 52.000 )*                            *         *****               *******   **        ****
 48.000 )*        ***                 **        **        *                   **        ****      *
 44.000 )                             **        ***                 **        *         *
 40.000 )         *                   *                             **        *         *
 36.000 )         *                             **        *         ****                **        *
 32.000 )                                       *                   *
 28.000 )                                       **                  *
 24.000 )                                                                               *

MEAN        70.100    70.625    79.250    68.919    55.531    74.000    53.148    63.905    53.045    77.208
S DEV        9.239    15.502     9.129    13.557    12.976    15.598    13.858    11.962    11.138    17.293
 N          20.       32.       36.       37.       32.       29.       27.       21.       22.       24.

       ALL GROUPS COMBINED        (SPECIAL VALUES EXCLUDED)                TOTAL N                  = 280
                                                                           NO. AT GRADE LEVEL OR ABOVE =  26
                  MEAN         67.0893                                     %   AT GRADE LEVEL OR ABOVE =   9.3
                  S DEV        16.0555
                 MAXIMUM      110.0000
                 MINIMUM       25.0000
```

INTERVAL INCLUDING GRADE EQUIVALENT OF 4.0

HISTOGRAMS OF BOND-CLYMER-HOYT PHONETIC KNOWLEDGE SCORES FOR FOURTH GRADE CLASSES

(PRINTED INTERVAL DESIGNATIONS ARE LOWER LIMITS OF CLASS INTERVALS)

	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7	GROUP 8	GROUP 9	GROUP 10
SPECIAL VALUES										
999.= NO SCORE										
998.= INVALID										
999.000)	*	**	*******	**	**	**	****	****	***	*
998.000)										

TABULATIONS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES

INTERVAL	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7	GROUP 8	GROUP 9	GROUP 10
112.000)										
108.000)	**			*						
104.000)	****			*						
100.000)	******	**		***			**		*	
96.000)	********	*		**	*			***	****	
92.000)	*	***		***	**		******		****	*
88.000)	*	***	*	*****	****	***			******	*
84.000)	*****	****	*****	****	******	**		**	**	*
80.000)		****		****	******	*	***	***	*	**
76.000)	*	***	**	****	****	**	***	*	**	
72.000)		**	*****	***	**	*	***	***	*	****
68.000)	*		**		**	***	**	**	*	***
64.000)		**	****	*	*	***		********	**	**
60.000)			****			***	**		**	******
56.000)		*	**			**	**	*		***
52.000)						***	***		*	
48.000)										**
44.000)			*			*			*	*
40.000)						*		*		*
36.000)										**
32.000)								**		
28.000)										
24.000)									*	
20.000)										
MEAN	96.207	83.680	71.577	87.581	82.143	68.000	77.192	70.731	80.345	64.448
S DEV	9.741	11.029	10.904	10.446	7.863	13.577	15.158	16.472	18.378	14.576
N	29.	25.	26.	31.	28.	25.	26.	26.	29.	29.

INTERVAL INCLUDING GRADE EQUIVALENT OF 5.0

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED

MEAN	78.4781
S DEV	16.0106
MAXIMUM	110.0000
MINIMUM	24.0000

TOTAL N = 273
NO. AT GRADE LEVEL OR ABOVE = 26
% AT GRADE LEVEL OR ABOVE = 9.5

HISTOGRAMS OF BOND-CLYMER-HOYT PHONETIC KNOWLEDGE SCORES FOR FIFTH GRADE CLASSES

```
                                    (PRINTED INTERVAL DESIGNATIONS ARE LOWER LIMITS OF CLASS INTERVALS)

          GROUP  1  GROUP  2  GROUP  3  GROUP  4  GROUP  5  GROUP  6  GROUP  7  GROUP  8  GROUP  9
         ..........+.........+.........+.........+.........+.........+.........+.........+.........+
SPECIAL
 VALUES
999.= NO SCORE
998.= INVALID
999.000 )*         **        *         ***       *                   *         *
998.000 )

        TABULATIONS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
INTERVAL


208.000 )
200.000 )
192.000 )
184.000 )
176.000 )
168.000 )
160.000 )
152.000 )
144.000 )
136.000 )
128.000 )
120.000 )
112.000 )**        **        ***                           **
104.000 )****      ****      *******             ***       *                   *
 96.000 )*****     *********13*********  ***       ********* ***                 ***       *
 88.000 )********* ******    *****     ********  ***       ********* ***       *****     ********
 80.000 )********* ***       *******   *******   *****     *******   *******   ********  *******
 72.000 )***       **        *         ****      ***       **        *****     **        ******
 64.000 )          ***       **        *******             **        **        **        **
 56.000 )*                             *         *         *         *****               *
 48.000 )                                                            *         *
 40.000 )                                                            **                  *
 32.000 )
 24.000 )
 16.000 )
  8.000 )
  0.000 )                                                                                *
 -8.000 )


MEAN      92.333    93.697    95.471    81.567    91.375    92.926    72.080    84.182    78.222
S DEV     11.698    12.824    12.551    11.010    12.867    27.067    14.210    11.987    19.037
 N        33.       33.       34.       30.       24.       27.       25.       22.       27.

        ALL GROUPS COMBINED        (SPECIAL VALUES EXCLUDED)               TOTAL N                    = 255
                                                                           NO. AT GRADE LEVEL OR ABOVE =  11
                  MEAN          87.4510                                    %   AT GRADE LEVEL OR ABOVE =   4.3
                  S DEV         17.0013
                 MAXIMUM       120.0000
                 MINIMUM         0.0000
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INTERVAL INCLUDING GRADE EQUIVALENT OF 6.0

HISTOGRAMS OF BOND-CLYMER-HOYT PHONETIC KNOWLEDGE SCORES FOR SIXTH GRADE CLASSES